REMARKS

In accordance with the foregoing, claims 1 and 2 have been amended. New claim 14 has been added. Claims 1-3, 12 and 14 are pending and under consideration.

The rejection under 35 U.S.C. § 102 is respectfully traversed. Independent claim 1 recites the rotational phase of the second member with respect to the rotating member is settled using the positioning pin when attaching the second member to the rotating member. In contrast, JP '678 does not disclose a positioning pin. In fact, this reference does not disclose how the revolving superstructure 13 is attached to the carrier 26 (relied upon by the Examiner as corresponding to the claimed second member and rotating member, respectively). It is noted that the Office Action does not indicate which feature of the cited reference corresponds to the claimed positioning pin.

For the Examiner's convenience, translations of JP '678 are attached.

Accordingly, withdrawal of the rejection is requested.

New claim 14 is patentably distinguishable from the cited reference at least due to its dependency from claim 1.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 3-10-06

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Partial translation of JP 9-57678 A

[0008]

[Embodiments] In Figs. 1 and 2, reference numerals 11 denotes a main body (base) of an industrial robot. This main body 11 is formed with a space 12 through which wiring or piping is arranged. A rotary body 13 is arranged above the main body 11 and rotates around a vertical axis. The rotary body 13 is formed with a hole 14 which extends vertically and is coaxial with the vertical axis.

[0009] Reference numeral 17 denotes a differential type speed reducer, which has a cylindrical case 19 fixed to the main body at the top thereof. A number of pin teeth 20 is provided in the internal periphery of the case 19 at the intermediate height thereof. Each of these pin teeth 20 has a shape of cylinder and embedded half in the case 19, being arranged equidistance in a circumference. Reference numeral 21 denotes a pair of disk-type pinions houses in the case 19. These pinions are formed with a through hole having a long diameter. External teeth 23, of which number is smaller than that of the pin teeth 20, are formed in the external periphery of the pinion 21. These external teeth 23 are meshed with pin teeth 20. Reference numeral 26 denotes a carrier. The carrier 26 comprises a lower side flange 27 arranged on the lower side of the pinion 21 in the axial direction, upper side flange 28 arranged on the upper side of the pinion 21 and fixed to the rotary body 13, and a plurality of connecting rods 29 which extend vertically and whose lower end is integrally connected to the lower flange 27 but upper end is detachably connected to the upper flange 28. These connecting rods 29 are arranged loose inside the hole 30 formed in the pinion 31. Reference numeral 32 denotes a pair of bearings provided between the lower and upper flanges 27, 28 and the case 19, allowing the carrier 26 to rotate with respect to the case 19. Further, sealing member 33 is

provided between the lower and upper flanges 27, 28 and the lower and upper end of the case 19. Reference numeral 37 denotes a pair of crank pins which extend vertically and arranged equidistant in a circumference. The lower and upper ends of the crank pin 37 are supported by the lower flange 28 and upper flange 28 through the bearings 38, 39. Each of the crank pins 37 has two eccentric crank portions 40 at the center portion thereof. These crank potion portions 40 are inserted into the through hole 41 formed in the pinion 21, with needle bearing 42 interposed therebetween. Reference numeral 43 denotes a cylindrical body. The lower end of the cylindrical body 43 is inserted in the lower flange 27 and fixed to it. The central portion of the cylindrical body 43 in the axial direction is inserted loose in the through hole 22, and the upper end of the cylindrical body 43 is inserted loose in the 14 of the rotary body 13. Reference numeral 44 denotes a sealing member provided between the upper end of the cylindrical body 43 and the rotary body 13. These case 19, pinions 21, carrier 26, crank pins 37, and cylindrical body 43 constitute the speed reducer 17 which rotates the rotary body 13 around a vertical axial line by reducing and transmitting a rotational drive force provided to the crank pins 37 to the rotary body 13. The above-mentioned cylindrical body 43 is provided on the speed reducer 1. Thus, a hollow hole 45 is formed in the speed reducer 17 which communicates the internal part of the rotary body 13 with the space 12. Cables 46 are allowed to pass through the hollow hole 45.

[0010] Reference numeral 50 denotes a drive motor (servomotor). The output axis of the drive motor 50 is disposed apart from the center of the hollow hole 45 by a predetermined distance in a radial direction for the purpose of prevention of interference with the cables 46. This predetermined distance is greater than the distance between the center of the hollow hole 45 and the rotation axis of the crank pin 37. As a result, the crank pin 37 is located

between the output axis 51 of the drive motor 50 and the cylindrical body 43. The external gear 52 which serves as a first transmission member is fixed to the top portion of the output axis 51. An external gear 53 which serves a second transmission member is fixed to the upper portion of specific one 37a of the crank pins 37, which extrudes from the carrier 26. These external gear 53 is meshed directly with the external gear 52. Thus, rotational drive force of the external gear 52, transmitted to the external gear 52 directly, rotates the specific crank pin 37a first. Designing such that the external gear 52 and external gear 53 are meshed with each other, the drive motor 50 can be arranged around the crank pin 37a over a wide range. Within the speed reducer 17, more specifically, between the external gear 53 and the cylindrical body 43, cylindrical gear 55 which is coaxial with the hollow hole 45 is arranged. The lower end of the cylindrical gear 55 in the axial direction is rotatably supported through the bearing 56 by the upper flange 28. The upper end of the cylindrical gear 55 is rotatably supported through the bearing 57 by the rotary body 13. This cylindrical gear 55 is directly meshed with the external gear 53, as a result, this cylindrical gear 55 receives rotation drive force from the external gear 53directly and rotates. To the upper end of crank pin 37b. other than the specific crank pin 37a, which extrudes from the carrier 26, the external gear 58 to be directly meshed with the cylindrical gear 55 is fixed. This external gear 58 receives rotation drive force from the cylindrical gear 55 directly to rotate the crank pin 37b, distributing rotation torque to two crank pins 37.

[0011] Next, the operation of one embodiment of the present invention is explained below. For rotating the rotary body 13 with respect to the main body 11, the drive motor 50 is operated to rotate output axis 51 and the external gear integrally. At this time, as the external gear 53 is directly meshed with the external gear 52, the external gear 53 receives rotation drive forced

directly from the external gear 52, causing the specific crank pin 37a to rotate first. Thus, the pinion 21 eccentrically rotates with the crank pin 37a with the same number of rotation (that is, the crank pin 37a carries out eccentric revolution). The number of tooth of the external gear 23 of the pinion 21 of the case 19 is smaller than that of the pin teeth 20, and the external gear 23 is meshed with the pin teeth 20. Further, the case 19 is fixed to the main body so that it does not move. For this reason, the rotation drive force given to the specific crank pin 37a is reduced with a high reduction ratio by means of the case 19 and the pinion 20 and taken out by the carrier 26 and transmitted to the rotary body 13. Thus, the rotary body rotates around the vertical axial line with low speed and large torque. At this time, to the crank pin 37b. other than the specific crank pin 37a, rotation drive force from the external gear 53 is transmitted through the cylindrical gear 55 and the external gear 58 being meshed with each other, so that these crank pins 37 b rotate in a similar way as the specific crank pin 37a. In this case, as the external gear 53 fixed to the specific crank pin 37a is located between the external gear 52 (output axis 51 of the drive motor 50) and the cylindrical gear 55, these external gears 52, 53 and the cylindrical gear 55 are made small-diameter gears, thereby allowing effective reduction of noise occurring when rotating. Only four gears, external gears 52, 53, 58 and cylindrical gear 55, are required for rotating two crank pins, 37a and 37b, so that construction is simple and manufacturing cost is low.

[0012] Figs 3 and 4 show a second embodiment of the present invention. In this embodiment, a pulley 60 is used as a first transmission member fixed to the output axis of the drive motor 50. Also, a pulley 61 is used as a second transmission member fixed the specific crank pin 37a. A timing belt 62 is laid on these pulley 60, 61 so that rotation drive force is transmitted from the pulley 60 to pulley 61. In this embodiment, an intermediate gear is

provided on the specific crank pin 37a at the center portion thereof, more specifically, between two crank portions 40. Further, a cylindrical gear 65 is provided between the pinion 21 and the intermediate gear 63 and cylindrical body 43, and the both ends of the cylindrical gear 65 is rotatably supported by the carrier 26 through the bearing 64. Meshing the intermediate gear 63 with the cylindrical gear 65 directly, rotation drive force of the pulley 61 is transmitted to the cylindrical gear 65 through the specific crank pin 37a and the intermediate gear 63. Further, the cylindrical gear 65 is meshed directly with the external gear 66 provided on the other crank pin 37b at the center portion thereof in the axial direction. As a result, the crank pin 37b rotates in the same direction at the same speed as the crank pin 37a. As the intermediate gear 63 is provided on the crank pin 37a at the center portion thereof in the axial direction, wherein the both ends of the intermediate gear 63 are supported, noise caused due to meshing with the cylindrical gear 65 is reduced. And as only a rotation force of the crank pin 37a is transmitted to the crank pin 37b through the cylindrical gear 65 and external gear 66, the width can be reduced. Further, rotation of two crank pins 37a, 37b will requires only five elements, pulley 60, 61, intermediate gear 63, cylindrical gear 65, and external gear 66.
As a result simple structure is realized and manufacturing cost is low.

[0013]

[Explanation of the drawings]

[Fig. 1] front view (cross section) of a first embodiment of the present invention.

[Fig. 2] cross section of Fig. 1 as viewed from I-I.

[Fig. 3] front view (cross section) of a second embodiment of the present invention.

[Fig. 4] cross section of Fig. 2 as viewed from II-II.

Fig. 1

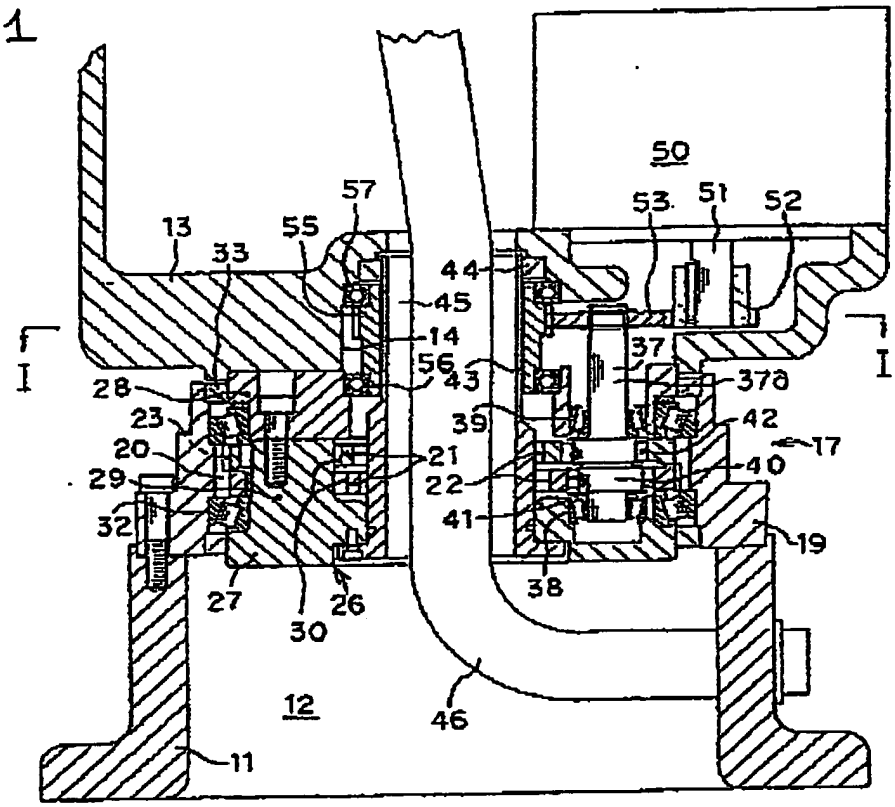
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Fig. 2

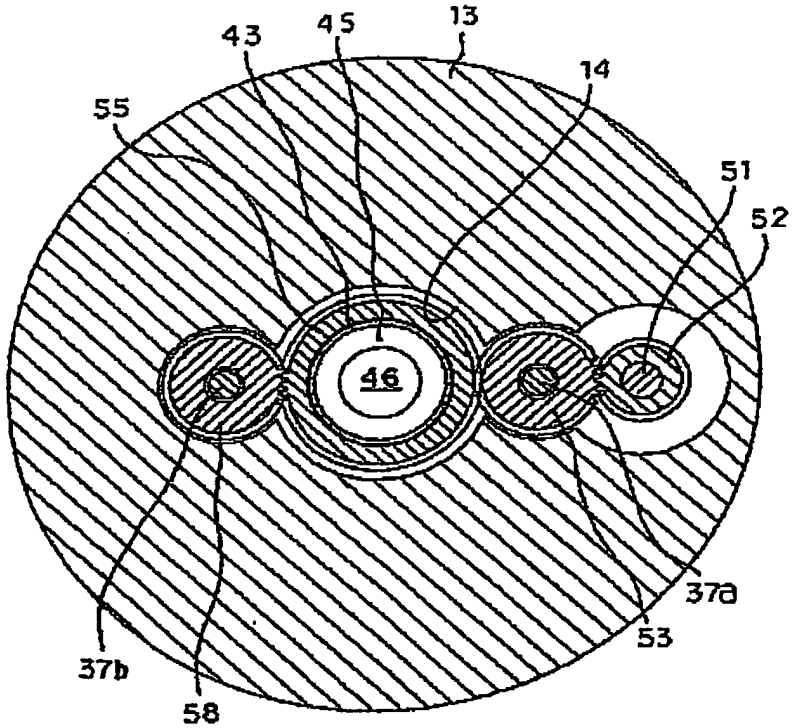
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Fig.3

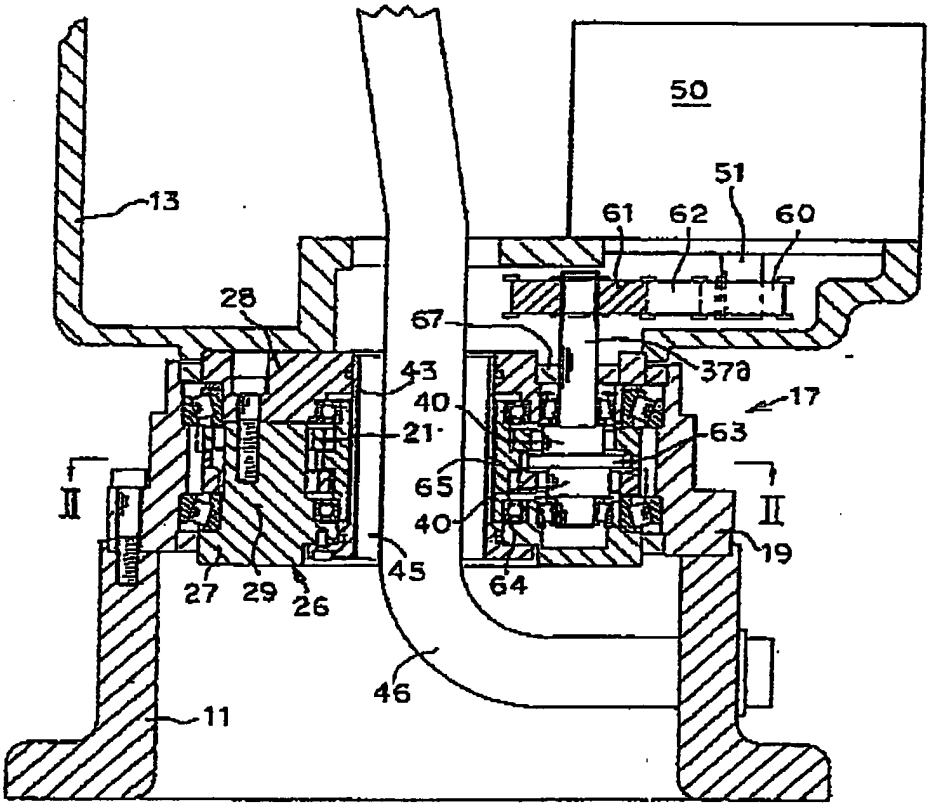
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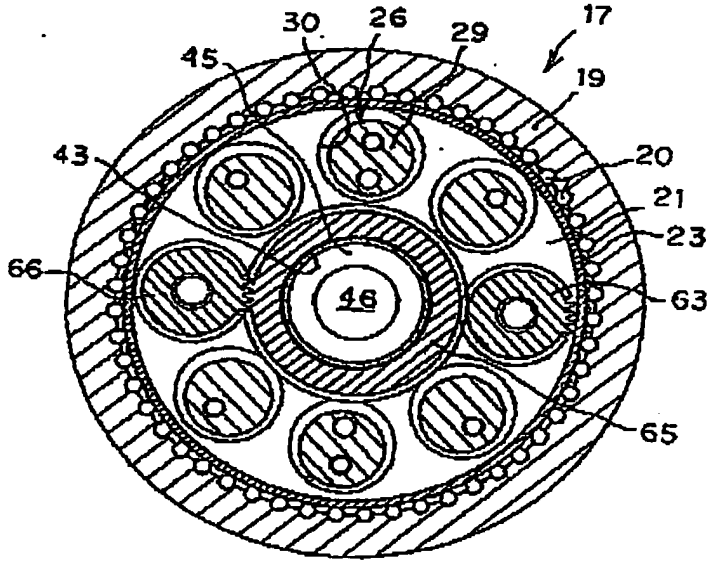
Fig.4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PATENT ABSTRACTS OF JAPAN

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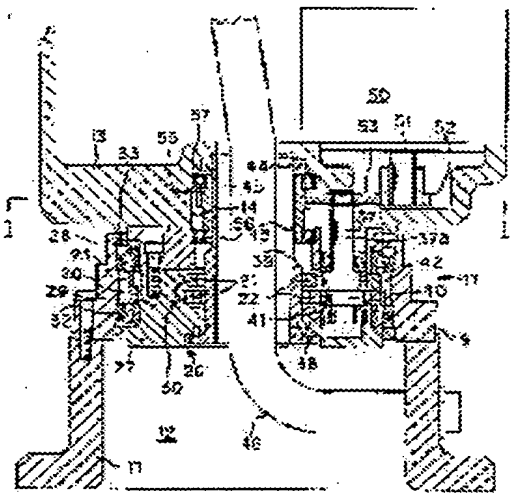
(72)Inventor : KURITA MASAAKI

(54) TURNING PART STRUCTURE OF ROBOT OR THE LIKE

(57)Abstract:
PROBLEM TO BE SOLVED: To effectively reduce a noise at the time of turning while a structure is simple and inexpensive.
SOLUTION: Since an external gear 53 fixed to a crankpin 37a is positioned between an external gear 52 (an output shaft 51 of a driving motor 50) and a cylindrical gear 55, these external gears 52 and 53 and cylindrical gear 55 can be formed into a small diameter, and a noise at turning time is reduced. In order to rotate two crankpins 37, they merely need four gears consisting of external gears 52, 53, and 58, and the cylindrical gear 55, which result in simple structure and low manufacturing cost.



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CLAIMS

[Claim(s)]
[Claim 1] A tool array data storage means to memorize the tool array data in an NC machine tool, The input data processing section which processes the processing location data inputted from an input means, and generates two or more processing location data, A processing location data storage means to memorize two or more processing location data generated in said input data processing section, The processing condition input-process section which processes the processing condition data inputted from an input means, The processing location data read from said processing location data storage means based on the processing condition data processed by said processing condition input-process section, the processing program generation processing section which chooses two or more tools which carry out coincidence processing by one shot from the tool array data read from said tool array data storage means, and generates a processing program — since — NC programming equipment characterized by becoming.
[Claim 2] The 1st step which memorizes the tool array data in an NC machine tool, The 2nd step which processes the processing location data inputted from an input means, and generates two or more processing location data, It is based on the 3rd step which inputs processing condition data from an input means, and said inputted processing condition data. The NC programming approach which carries out the description of consisting of the 4th step which chooses two or more tools which carry out coincidence processing by one shot from tool array data and said inputted processing location data, and generates a processing program.
[Claim 3] Based on the information said input data processing section indicates the information on a processing location, the information on the distance between processing locations, and the number of processing locations to be in NC programming equipment according to claim 1, it is NC programming equipment characterized by generating two or more processing location data.
[Claim 4] The information which shows the information on said processing location, the information on the distance between processing locations, and the number of processing locations in NC programming equipment according to claim 3 is NC programming equipment characterized by constituting so that it may input from an input means according to the processing location data input menu screen displayed on a display means.
[Claim 5] According to the processing condition data input menu screen where said processing condition data are displayed on a display means in NC programming equipment according to claim 1, it is NC programming equipment characterized by constituting so that it may input from an input means.
[Claim 6] Based on the information on a processing location that said 2nd step is inputted from an input means in the NC programming approach according to claim 2, the information on the distance between processing locations, and the information that shows the number of processing locations, it is the NC programming approach characterized by generating two or more processing location data.
[Claim 7] It is the NC programming approach which carries out the description of choosing two or more tools which carry out coincidence processing by one shot, and generating a processing program from tool array data and processing location data based on the processing condition data into which said 4th step was inputted in the NC programming approach according to claim 6.

[Translation done.]

DETAILED DESCRIPTION JP. 09-057678 A

[Detailed Description of the Invention]
[0001]
[Field of the Invention] In case this invention manufactures furniture etc., it relates to NC programming equipment which can create easily the processing program for processing a request into a detail in two or more processing locations by one shot on a user side, and its creation approach further about NC programming equipment used for the various processing locations on a work piece in the NC machine tool which performs hole processing etc., and its creation approach.
[0002]
[Description of the Prior Art] The example which makes a cabinet, a chitin facility, etc. a equipment is in use at the time of construction, standardization with the fixed size of a product etc. progresses, an NC machine tool is used for an apartment, a ready-built house, etc. in the manufacture, and processing of cutting, grinding, hole processing, etc. is increasingly performed these days according to NC program. For example, machine tools, such as NC router, are conventionally used for the side plate of furniture etc. as a machine tool which carries out hole processing.
[0003] Generally, machine tools, such as early NC router, were the 1 so-called boring / structures of one shot which carry out hole processing in one processing actuation of a tool at one place, and were what describes the diameter of a tool, the processing depth, etc. as a processing command serially for every processing location about all the processing locations that should carry out hole processing also of the processing program, and goes.
[0004] However, in recent years, from the request of floor-to-floor-time compaction, the so-called two or more boring / NC machine tool of one shot which sets two or more tools to the driving shaft, uses two or more tools chosen in one processing actuation, and performs two or more hole processings to coincidence is developed, and the side plate of furniture etc. is increasingly used for much locations by processing of the work piece which needs hole processing.
[0005]
[Problem(s) to be Solved by the Invention] However, in two or more boring / NC machine tool of one shot like the above, although floor to floor time is shortened, the problem which the burden placed on the operator treating an NC machine tool or a programmer increases exists. It is increase of NC programming man day resulting from the difficulty of creation of the command in processing, i.e., NC program, having become high.
[0006] That is, as difficulty of NC programming, it was low, and the man day of NC programming was [that NC program in 1 boring / NC machine tool of one shot creates at a time the processing location (the X-axis, Y axial seat label location) shown in the design drawing and a bore diameter (diameter of a tool), and one step (Z-axis movement magnitude) of processing depth for every processing location, and should just go] small.
[0007] on the other hand by creation of NC program in two or more boring / NC machine tool of one shot, as for the operator or the programmer, the tool of the path of how much is arranged first in which location the 1st -- moreover, arrangement spacing of each tool etc. needs to have full knowledge of the data about the array of two or more tools. It is required for the 2nd from a design drawing that which processing location and which processing location should create the processing command of one shot (one step), judging whether hole processing is possible in one processing actuation (one shot) from the aforementioned tool array.

[0008] Therefore, un-arranging [that the difficulty of NC programming was high and the man day of NC programming increased] had arisen.
[0009] As mentioned above, although improvement in working efficiency and compaction of working hours will be mechanically attained by using two or more boring / NC machine tool of one shot, creation of NC program by the operator or the programmer has brought about decline in working efficiency, and increase of working hours conversely, and the factor from which it prevents improvement in productivity that it is also difficult to secure talented people with the high level of skill conjointly had produced the problem.
[0010] This invention is made in order to solve such a conventional problem, and it aims at offering NC programming equipment which can create easily the processing program for processing a request on two or more processing locations by one shot on a user side, and its creation approach.
[0011]
[Means for Solving the Problem] A tool array data storage means to memorize tool array data [in / in this invention / an NC machine tool] in order to attain the aforementioned purpose, The input data processing section which processes the processing location data inputted from input means, and generates two or more processing location data, A processing location data storage means to memorize two or more processing location data generated in said input data processing section, The processing condition input-process section which processes the processing condition data inputted from an input means, The processing location data read from said processing location data storage means based on the processing condition data processed by said processing condition input-process section, the processing program generation processing section which chooses two or more tools which carry out coincidence processing by one shot from the tool array data read from said tool array data storage means, and generates a processing program -- since -- it is characterized by becoming.
[0012] Moreover, the 1st step which memorizes tool array data [in / in this invention / an NC machine tool], The 2nd step which processes the processing location data inputted from an input means, and generates two or more processing location data, It is based on the 3rd step which inputs processing condition data from an input means, and said inputted processing condition data. Two or more tools which carry out coincidence processing by one shot are chosen from tool array data and said inputted

processing location data, and the description of consisting of the 4th step which generates a processing program is carried out.
[0013] Therefore, NC program for processing a request on two or more processing locations by one shot easily can be created on a user side.
[0014]
[Embodiment of the Invention] NC programming equipment 10 of this operation gestalt The master CPU 12 which performs synthetic control of the NC programming equipment 10 concerned CRT14 as a monitor display means, and the keyboard 16 as an input means installed in this CRT14 side by side, It has ROM18 which memorizes the control program for controlling NC programming equipment 10, and RAM20 which memorizes input data and the result of an operation temporarily, and connects with NC machine tool 34 through the interface (henceforth I/F) circuit 22. NC machine tool 34 has the processing section 36 in which two or more tools were beforehand arranged by the driving shaft.
[0015] The tool array data storage section 32 NC programming equipment 10 remembers further the tool array data of two or more tools arranged beforehand at the processing section 36 of NC machine tool 34 to be, The input data processing section 24 which processes the processing location data inputted from a keyboard 16, The processing location data storage section 26 which memorizes the processing location data processed in the input data processing section 24, The processing condition input-process section 28 which processes the processing condition data inputted from a keyboard 16, The tool array data memorized by the processing location data and the tool array data storage section 32 which were memorized by the processing location data storage section 26, From the processing condition data inputted into the processing condition input-process section 28, it consists of the processing program generation processing section 30 which generates a processing program (NC program), and a bus line 38.
[0016] By NC programming equipment 10 constituted as mentioned above, NC program in two or more boring / NC machine tool of one shot is created.
[0017] Next, actuation of the approach of creating NC program with this NC programming equipment 10 and NC programming equipment 10 is explained to a detail, referring to a drawing. In addition, in the following explanation, the activity of selection, a setup, an input, etc. is made, when an operator operates a keyboard 16.
[0018] As an example, the processing section 36 of NC machine tool 34 has the tool array in which tools T1-T13 were arranged by Y shaft orientations, and tools T14-T26 were arranged by X shaft orientations, as shown in drawing 2 . a tool T1, T four, T6 - T8, and T11-T13 — a path — 7.8mm, a tool T2, and T14-T26 — a path — 5.0mm, tool T3, and T10 — a path — 5.6mm, a tool T5, and T9 a path — 8.6mm — it is — each — each spacing between tool T1 -T26 is 30mm. the tool array data storage section 32 of NC programming equipment 10 — each — data, such as the array direction of tool T1 -T26, a path, and tool spacing, are inputted and memorized.
[0019] As NC machine tool 34 which has such a tool array shows to drawing 3 , it is hole a1 -a5, b1 -b5, c1 -c5, d1 -d5, and e1 -e4 to a work piece W. The case where it is processed is explained to an example below about actuation of NC programming equipment 10 and processing.
[0020] In addition, it is hole a1 -a5, using the left corner of a work piece W as a co-ordinate basic origin O in drawing 3 . From the location of X= 100 and Y= 100, processing location data are 30mm spacing, and show performing five hole processing whose path (phi) is 5.0mm and whose processing depth (Z) is 10mm to X shaft orientations. Moreover, hole c1 -c5 Processing location data show performing five hole processing whose path (phi) is 7.8mm and whose processing depth (Z) it is 90mm spacing and is 10mm to Y shaft orientations from the location of X= 500 and Y= 50, and are hole b1 -b5, d1 -d5, and e1 -e4. The same is said of a case.
[0021] Fundamentally, NC programming equipment 10 of this operation gestalt is the so-called interactive equipment which makes correction by the simulation result which an operator performs selection of processing, and an entry of data based on the menu screen concerned, and is displayed on CRT14 by displaying a predetermined menu screen on CRT14, or displaying a simulation result like the after-mentioned.
[0022] If NC programming equipment 10 is started, a master CPU 12 will read the initial screen (processing selection screen) for choosing processing of the NC programming equipment 10 concerned of operation from ROM18, and will display it on CRT14 (refer to drawing 4). In the processing selection screen of drawing 4 , the predetermined key of the keyboard 16 arranged in CRT14 is pressed by the operator.
[0023] First, in the processing selection screen of drawing 4 , an operator chooses a "work-piece data input" and inputs data, such as a dimension of the work piece W (refer to drawing 3) which should be processed from a keyboard 16, based on the input screen (not shown) displayed on CRT14. If this input is completed and "termination" is chosen from a keyboard 16, a master CPU 12 will read the processing selection screen (drawing 4) for choosing processing of the NC programming equipment 10 concerned of operation from ROM18, and will display it on CRT14 again.
[0024] Next, if a "processing location data input" is chosen in order that an operator may input processing location data, a master CPU 12 will read the data of a data input screen from ROM18, and will display them on CRT14 (refer to drawing 5). In this data input screen, the path phi of the hole which should be processed, X coordinate (X), Y coordinate (Y), a Z coordinate (Z), the data (XP) in which it is shown at intervals of how much the same thing is in X shaft orientations how many, and the data (YP) in which it is shown at intervals of how much the same thing is in Y shaft orientations how many are inputted. For example, hole a1 -a5 of drawing 3 and b1 -b5 And e1 -e4 If it inputs about each processing location, it will become like drawing 6 . drawing 6 — hole a1 -a5 and b1 -b5 Path phi is 5mm. ******** — Since 100mm and Y coordinate input 100mm, a Z coordinate inputs [X coordinate] 10mm and there are the five holes same at intervals of 30mm as X shaft orientations, Since there are the two holes same at intervals of 300mm as XP=30x5 piece and Y shaft orientations, YP=300x2 piece is inputted, and it is hole e1 -e4. If it attaches Since it is Y shaft orientations with inequality spacing, it is YPV=30. 90 When a package addition key is pressed in this condition, as the screen in the condition of having inputted 30 is shown, and input data is processed by the input data processing section 24 and it is shown in drawing 7 and drawing 8 hole a1 -e4 up to — while the processing location data for every processing location of 14 pieces are created and the processing location data storage section 26 memorizes, a processing location is displayed on the work piece W displayed on the processing data input screen of CRT14. It is hole a2 -a5, b1 -b4, and e1 -e4 here. If it attaches, it is the same as that of drawing 7 and drawing 8 , and illustration is omitted.
[0025] the same — carrying out — hole c1 -c5 and d1 -d5 about — if data are inputted, it will become like drawing 9 .
[0026] drawing 9 — hole c1 ********, since Path phi is 7.8mm, 500mm and Y coordinate input 50mm, a Z coordinate inputs [X coordinate] 10mm and there are the two holes same at intervals of 400mm as X shaft orientations Since XP has the five holes same at intervals of 90mm as 400x2 pieces and Y shaft orientations, YP is a hole c1, as input data is processed by the input data processing section 24 and it is shown in drawing 10 , when the screen in the condition of having inputted 90x5 pieces is shown

and a package addition key is pressed in this condition. Processing location data are created. the same — hole c2 –c5, and d1–d5 up to — while the processing location data for every processing location of ten pieces are created and the processing location data storage section 26 memorizes, a processing location is displayed on the work piece W of the processing data input screen of CRT14.

[0027] After a processing location entry of data is completed as mentioned above, a master CPU 12 reads the initial screen (processing selection screen) for choosing processing of NC programming equipment 10 of operation from ROM18, and displays it on CRT14 again. If a "processing condition input" is chosen in order that an operator may input processing conditions, a master CPU 12 will read the data of a processing condition input screen from ROM18, and will display them on CRT14 (refer to drawing 11).

[0028] In the processing condition input screen of drawing 11 , an operator performs a cursor advance and sets up processing conditions, such as the processing approach assignment, assignment in the same shot, processing initiation side side assignment, and the processing approach of each processing side (FACE1–FACE5). Setting up whether the mirror processing consideration in the processing approach assignment is processing in consideration of right and left being reversed like the condition that processing location data projected the right–hand side plate and the left–hand side plate on the mirror in processing of side plates, such as furniture, assignment of the same shot sets up only the tool of whether two or more diameters of a tool are intermingled, and the diameter of the same.

[0029] As a processing initiation side is specified when an operator wants to set up from which field of the work piece which should be processed processing is started, and shown in drawing 12 Field F1 –F5 of a work piece W Inside, a field F1, F2, and F4 When carrying out hole processing, it is a field F2. When it sets up so that it may be processed first, it is after that, a field F1, and F4. Order or a field F4, and F1 Processing is performed in order. When it was first processed about all fields and sets up, NC programming equipment 10 determines the field of arbitration, and subsequent processings are performed.

[0030] Moreover, in a setup of the processing approach of FACE1, the processing conditions which set up whether it is processed in order of the coordinate of a Y–axis or it is processed in order of the coordinate of the X–axis, and were set up from the processing condition input screen as mentioned above are processed and memorized in the processing condition input–process section 28.

[0031] After a setup of processing conditions is completed, a master CPU 12 reads a processing selection screen, and displays it on CRT14 again. In order that an operator may generate NC program, when "processing activation" is chosen, the processing program generation processing section 30 As shown in the flow chart which shows outline processing of NC program generation of drawing 13 In a step ST 1, read processing location data from the processing location data storage section 26, and it sets to a step ST 2. Tool array data are read from the tool array data storage section 32, processing location data and tool array data are compared and processed, and the tool used for every processing location is chosen (step ST 3).

[0032] Next, in a step ST 4, the processing program generation processing section 30 performs the check of the processing location which can carry out coincidence processing in one shot, and a processing tool, and generates the processing program of one step (step ST 5).

Generation processing of the program in the processing program generation processing section 30 can be performed according to the detail flowchart shown in drawing 14 . Namely, in a step ST 10, each processing location data are read from the processing location data storage section 26 one by one. If processing location data are not the last (step ST 11), in a step ST 12, each tool array data will be read from the tool array data storage section 32 one by one. If tool array data are not the last (step ST 13), in a step ST 14, one processing location data read at a step ST 10 will be compared with one tool array data read at a step ST 12.

[0033] As a result of the path of the hole and the path of a tool in processing location data being compared by the step ST 14, if not in agreement, return and the following tool array data are read into a step ST 12. If a path is in agreement and tool array distance and a processing location are not [the array distance of the tool which corresponded is compared with the processing location of the hole in processing location data in a step ST 15 and] in agreement, return and the following tool array data are read into a step ST 12. If a path and tool array distance are in agreement, in a step ST 16, one processing tool to one processing location is determined, and a flag [finishing / selection] is given to the tool concerned here.

[0034] Although reading of the processing location data in a step ST 10 and a step ST 12 and reading of tool array data were explained as what reads each data one by one, it is also possible to consider as the procedure which reads all processing location data and tool array data at once, and processes them.

[0035] If one processing tool to one processing location is determined, the check of whether to be a processing location and a processing tool processible into coincidence by one shot and a check will be performed, the processing location and the processing tool which carry out coincidence processing by one shot will make into a group in a step ST 18, and the NC program of one step will be generated in a step ST 17 in a step ST 16. Under the present circumstances, when the processing location and processing tool which are not processible into coincidence by one shot remain, the processing from reading of return and processing location data will be again repeated to a step ST 10.

[0036] Drawing 15 is an example of NC program generated by doing in this way, and is NC example program for processing the work piece W shown in drawing 3 . Step L001 shows the magnitude of a negative. Steps L002, L003, and L004 are comment lines, and it is shown as processing conditions (refer to drawing 11) that processing, the diameter of the same / one shot, processing from the FACE3 side, and the order of processing usually set up the order of X coordinate.

[0037] Step L005 is hole a1 –a5. For 100mm and a Z coordinate (processing depth), it is the command to process, and X coordinate is 10mm, and drives tools T22–T26 (refer to the diameter of a tool of 5.0mm, tool spacing of 30mm, and drawing 2) to coincidence by one shot, and 100mm and Y coordinate are hole a1 –a5. Processing it is shown.

[0038] Similarly, step L006 is hole b1 –b5. For 100mm and a Z coordinate, it is the command to process, and Y coordinate is 400mm not as changeful as step L005 at 10mm, tools T22–T26 (5.0mm of diameters of a tool) are driven to coincidence by one shot, and X coordinate is hole b1 –b5. Processing it is shown.

[0039] Step L007 is hole c1 –c3 and c5. It is the command to process, and in 10mm, X coordinate is 500mm, Y coordinate is 50mm not as changeful as step L006, a Z coordinate drives a tool T1, T four, T7, and T13 (refer to 7.8mm of diameters of a tool, and drawing 2), and it is hole c1 –c3 and c5. Processing it is shown.

[0040] Step L008 is a hole c4. 500mm and a Z coordinate are not so changeful as step L007 at 10mm, Y coordinate is 320mm, and drives [it is the command to process, and] a tool T11 (the diameter of a tool of 7.8mm, tool spacing of 90mm) to coincidence by one shot, and X coordinate is a hole c4. Processing it is shown.

[0041] Step L009 is hole e1 –e4. It is the command to process and driving a tool T7, T8, and T11 and T12 (referring to 7.8mm of diameters of a tool and drawing 2) to coincidence by one shot from the location whose X coordinate is 400mm and whose Y

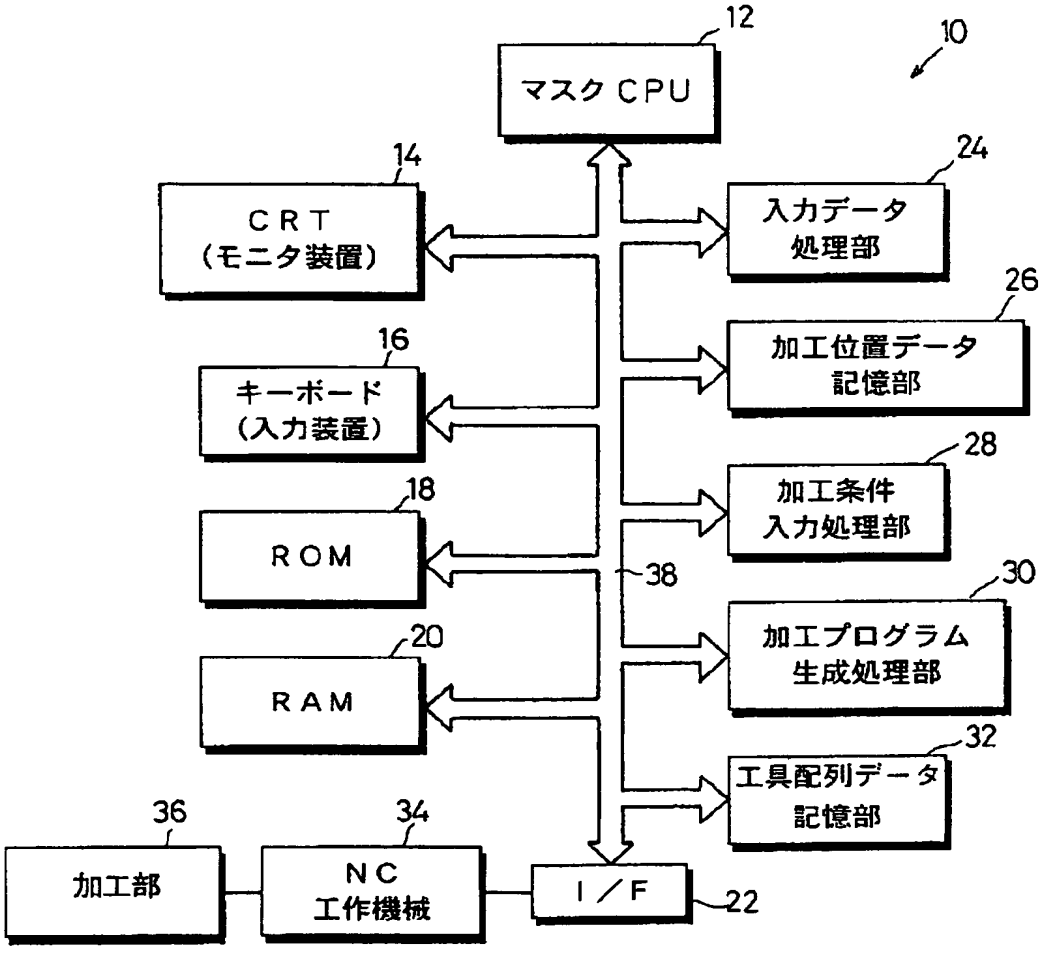
coordinate is 100mm, and performing hole processing is shown.
[0042] Step L0010 is a hole d4. 320mm and a Z coordinate are not so changeful as step L009 at 10mm, X coordinate is 900mm, and drives [it is the command to process, and] a tool T13 (the diameter of a tool of 7.8mm, tool spacing of 90mm) to coincidence by one shot, and Y coordinate is a hole d4. Processing it is shown.
[0043] Step L011 is hole d1 -d3 and d5. For 900mm and a Z coordinate, it is the command to process, and Y coordinate is 50mm not as changeful as step L007 at 10mm, a tool T1, T four, T7, and T13 (refer to 7.8mm of diameters of a tool and drawing 2) are driven, and X coordinate is hole d1 -d3 and d5. Processing it is shown.
[0044] Thus, created NC program can perform simulation by choosing and performing "simulation activation" in a processing selection screen (referring to drawing 4). Namely, as the simulation program memorized by ROM18 is performed and it is shown in drawing 16 , a master CPU 12 carries out simulation activation of a processing location, the one every step of the order of processing etc., etc., and displays it on the screen of CRT14.
[0045] Drawing 16 is hole a1 -a5 of step L005. The result of having carried out simulation of the command to process is shown, and it is hole a1 -a5 by tools T22-T26. It is shown that processing is performed.
[0046] When the order of processing and a shots per hour are unsatisfying with reference to the result of this simulation, an operator can change return and processing conditions into the processing input screen of drawing 11 , and can make the aforementioned processing perform again. If an EDIT registration key is pushed when it is what can satisfy the result of simulation, generated NC program will be registered as an executive program.
[0047] NC program generated by NC programming equipment 10 as mentioned above will be introduced into NC machine tool 34, and predetermined processing will be performed to a work piece W.
[0048] In addition, NC programming equipment and its creation approach of this invention of it being applicable also to the NC machine tool which has an axial array of those other than the operation gestalt mentioned above are natural.
[0049]
[Effect of the Invention] According to this invention, as mentioned above, an operator and a programmer By carrying out the sequential input of the processing location data from a design drawing, and setting up processing conditions according to the menu screen displayed on a display means From the tool array data memorized by NC programming equipment, processing location data processible by one shot are matched. Since the ** <TXF FR=0002 HE=055 WI=080 LX=1100 LY=0300> ** program of one step is generated, on a user side The effectiveness that NC program for processing a request on two or more processing locations by one shot easily can be created is acquired. Moreover, an operator etc. does not need to take the sequence of processing into consideration.
[0050] That is, in case one shot uses two or more boring / possible NC machine tool and attains improvement in working efficiency, and compaction of working hours, the difficulty of creation of NC program in an operator or a programmer can be reduced, and talented people with the high level of skill are not needed, but the effectiveness that improvement in the working efficiency and compaction of working hours are attained is acquired.

[Translation done.]

DRAWINGS

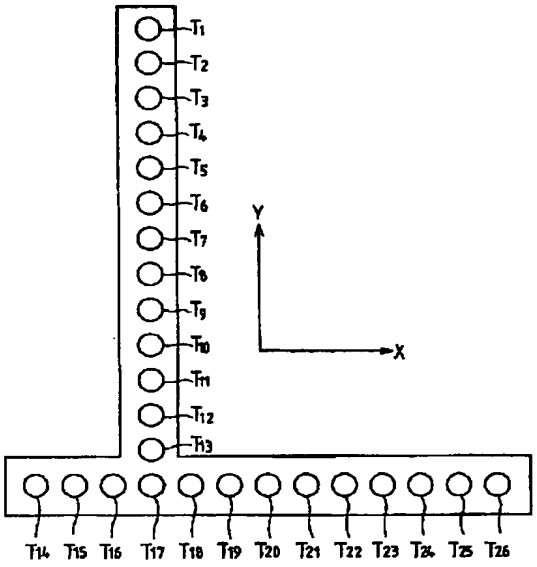
[Drawing 1]

FIG. 1



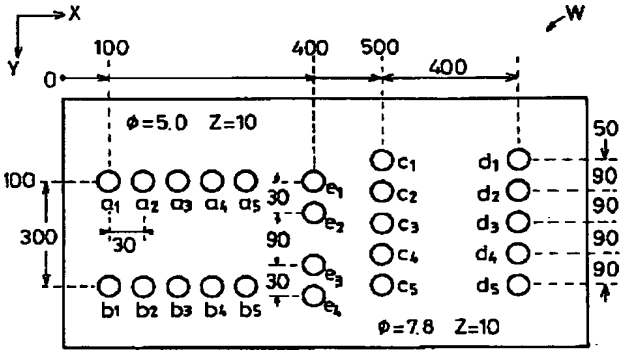
[Drawing 2]

FIG. 2



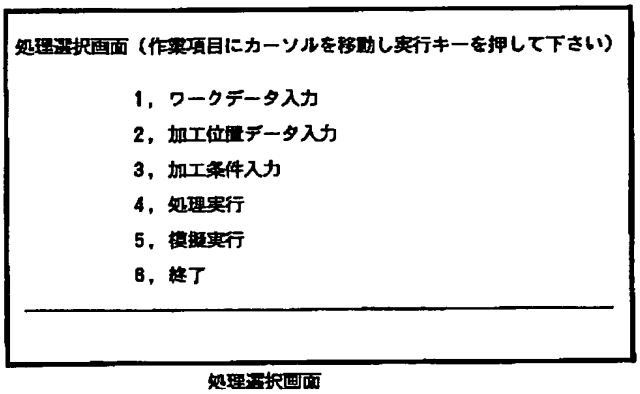
[Drawing 3]

FIG. 3



[Drawing 4]

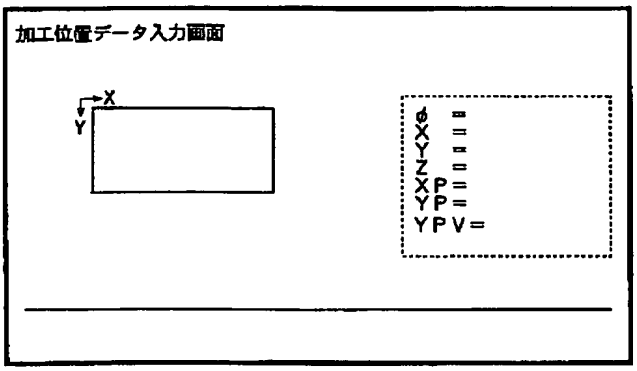
FIG. 4



処理選択画面

[Drawing 5]

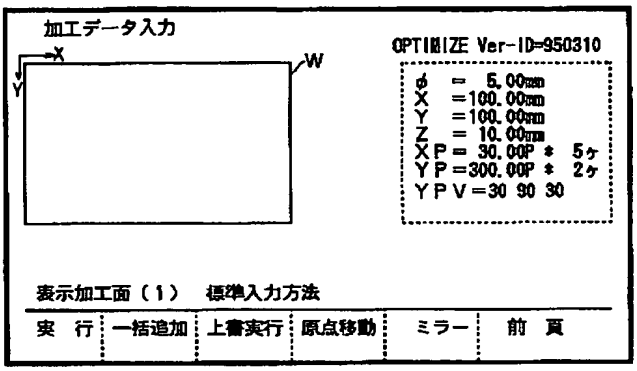
FIG.5



加工位置データ入力画面

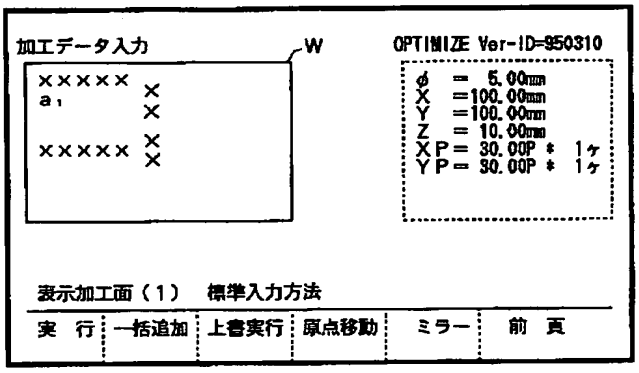
[Drawing 6]

FIG.6



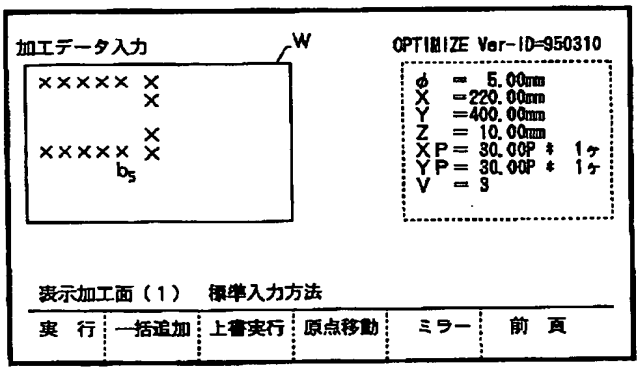
[Drawing 7]

FIG.7



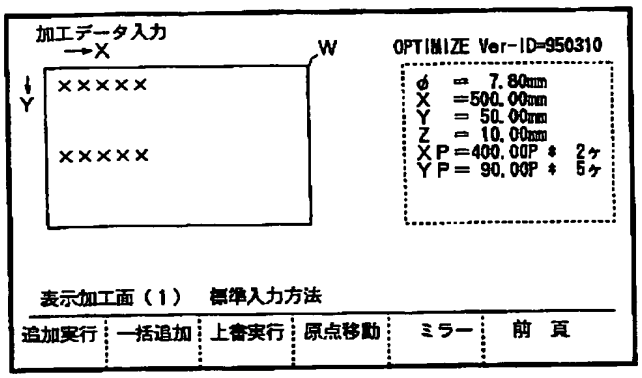
[Drawing 8]

FIG.8



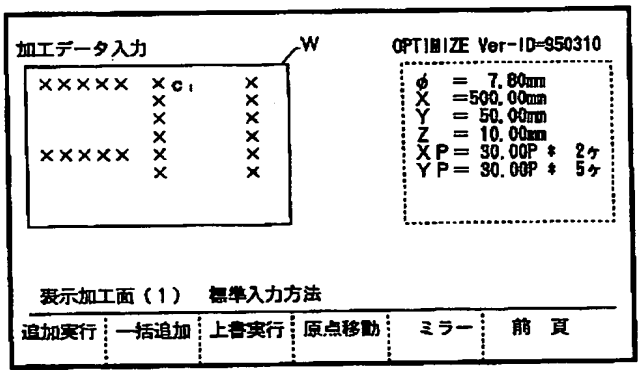
[Drawing 9]

FIG.9



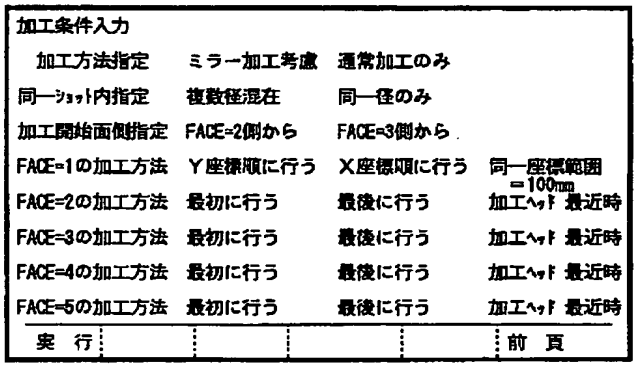
[Drawing 10]

FIG.10



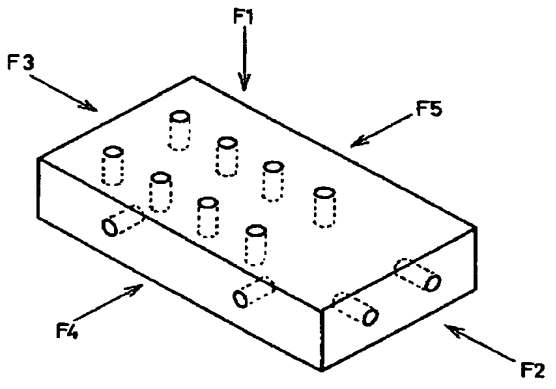
[Drawing 11]

FIG. 11



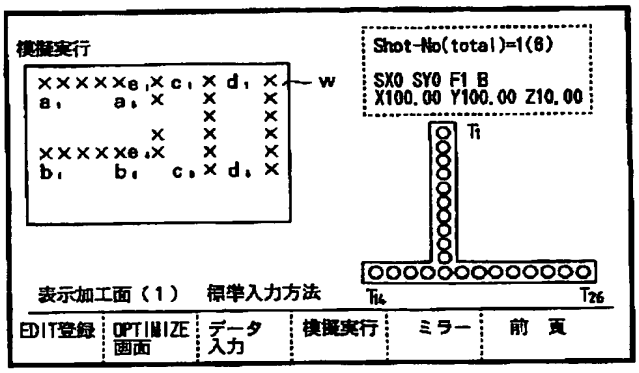
[Drawing 12]

FIG.12



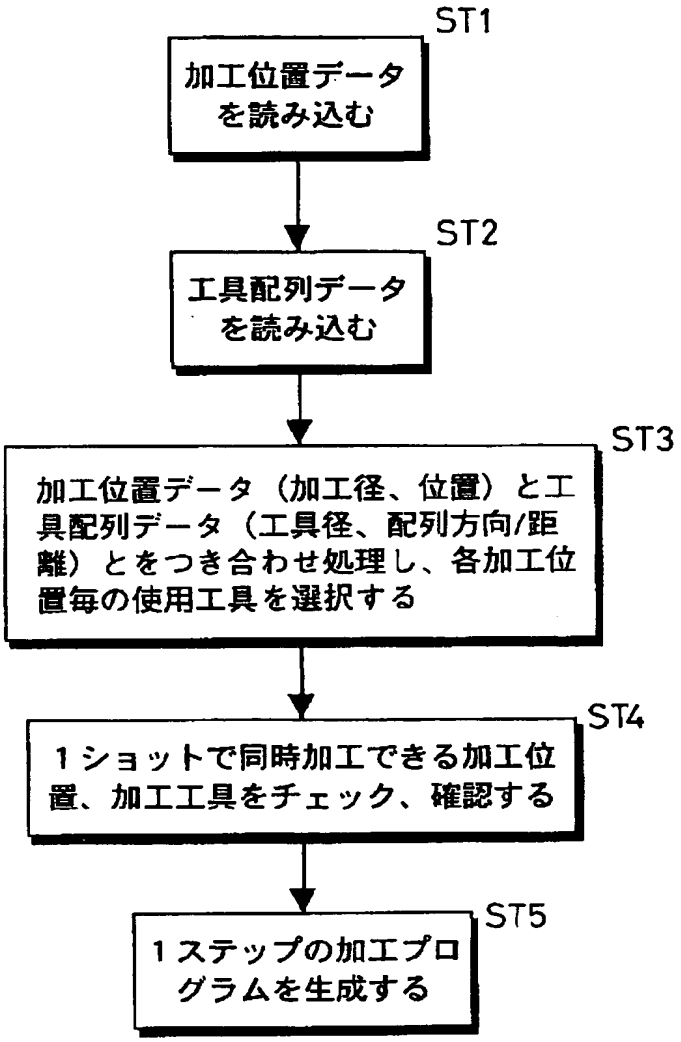
[Drawing 16]

FIG. 16



[Drawing 13]

FIG.13



[Drawing 15]

FIG.15

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[line-no=002]  *** OPTIMIZE-EDIT-CHANGE-M38(Ver.950419) date=95/07/05 time=13:40:17 ***
[line-no=003]  *** SHOT=  7( 24)  non-mirrer-req n-leng/1shot  FACE=3-start          ***
[line-no=004]  *** F1=Xside(100mm) F2=start F3=start F4=start F5=start               ***
[line-no=005]  B X100.00 Y100.00 Z10.00 T22 23 24 25 26
[line-no=006]  B Y400.00 T22 23 24 25 26
[line-no=007]  B X500.00 Y50.00 T1 4 7 13
[line-no=008]  B Y320.00 T11
[line-no=009]  B X400.00 Y100.00 T7 8 11 12
[line-no=010]  B X900.00 Y320.00 T13
[line-no=011]  B Y50.00 T1 4 7 13
[line-no=012]  ********************************************** OPTIMIZE-EOF  ***
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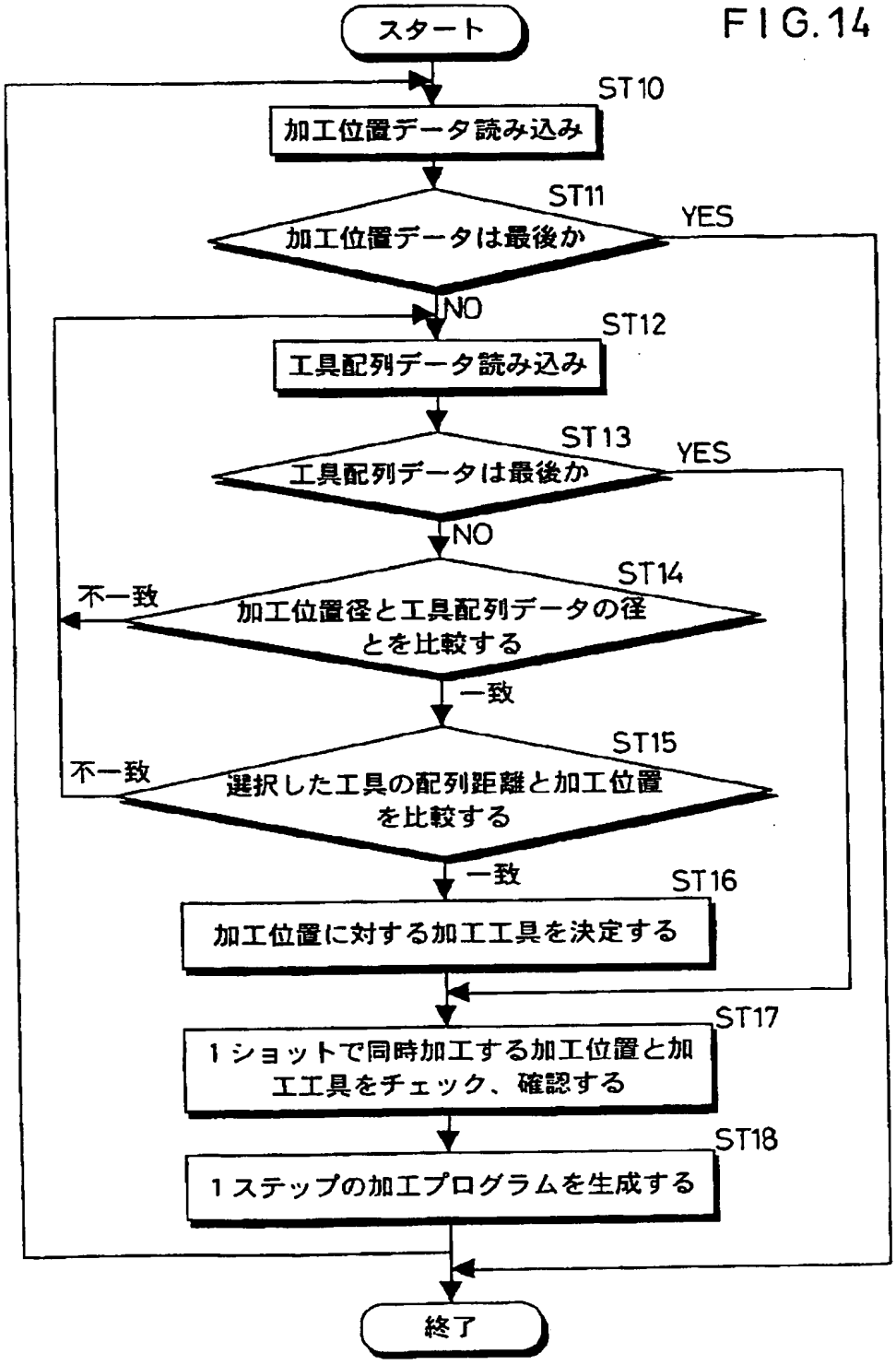
[Drawing 14]

FIG.14



[Translation done.]